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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/942,461	08/29/2001	Sadaaki Sakamoto	P/1071-1438	8084

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EXAMINER

MAYES, MELVIN C

ART UNIT	PAPER NUMBER
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1734

DATE MAILED: 10/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/942,461

Applicant(s)

SAKAMOTO, SADA AKI

Examiner

Melvin Curtis Mayes

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 August 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 and 12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 and 12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Claim Objections

(1)

Claim 7 is objected to because of the following informalities: the claim is incomplete.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

(2)

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

(3)

Claims 1-10 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuta et al. 5,456,778 in view of Nishigaki et al. 4,726,921, Nishigaki et al. 4,621,066 and Martin 4,853,349.

Fukuta et al. disclose a method of making a ceramic circuit substrate comprising: forming a green laminate of ceramic greensheets comprised of a mixed powder of glass and alumina with binder and having internal layer circuits printed thereon; providing unsintered ceramic greensheets of alumina, which do not sinter at the sintering temperature of the ceramic greensheets, on the surfaces of the green laminate; sintering at 800-1000°C; and removing the unsintered greensheets. The glass of the ceramic greensheets can be glass of the CaO-Al₂O₃-SiO₂-B₂O₃ system (col. 5, line 1 – col. 6, line 60). Fukuta et al. do not disclose sintering at a rate

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of more than 20°C/minute or precipitating crystalline forsterite, akermanite or diopside from the glass during firing.

Nishigaki et al. '921 teach that in the manufacture of a low temperature fired ceramic useful in electronic components, greensheets comprised of glass and alumina and firable at 800-1000°C can be fired with considerably reduced firing time by continuously firing the greensheets in an air furnace by rapidly heating at a heating rate of 10-200°C/min, preferably 20-200°C/min. Air is fed into the binder-removing zone of the furnace so that the air feed has a particular ratio. The low temperature fired ceramic composition are retained in a porous state up to the firing temperatures of 730-850°C without causing softening and shrinking of the glass phase and thereby binder is removed without causing cracks or incorporating carbon, and since the ceramics are rapidly shrunk and sintered during firing, a dense ceramic substrate can be readily obtained in a shortened period. Further, at firing, deformation of fine conductor pattern is minimized. The rapid sintering ability is due to the partial crystallization of the low temperature ceramic composition. The low temperature firable greensheets comprise alumina and a glass, the glass being a $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2\text{-B}_2\text{O}_3$ system non-crystallized glass with up to 10% impurities and which is partially crystallized in the course of the firing step and precipitates crystals of anorthite (col. 5, line 30 – col. 8, line 31).

Nishigaki et al. '066 teach that the impurities in the glass of low temperature fired ceramics of glass and alumina include oxides such as MgO (col. 4, lines 63-65).

Martin teaches that thermally-crystallizable glass compositions of $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2$ that contain MgO crystallize into gehlenite-akermanite-anorthite as the predominant crystalline phases (col. 3, lines 38-55, col. 4, lines 4-19).

It would have been obvious to one of ordinary skill in the art to have modified the method of Fukuta et al. for making a ceramic circuit substrate by sintering the green laminate of glass and alumina at a rate in the range of 20-200°C/min, as taught by Nishigaki et al. '921, as preferable to considerably reduce the firing time of the low temperature composition of glass and alumina, thus obtaining a dense ceramic substrate in a shortened period and with minimized deformation of fine conductor pattern. By sintering at a rate of 20-200°C/min, as taught by Nishigaki et al. '921 as preferable for rapid firing of a composition of alumina and glass which partially crystallizes during firing, sintering is performed in which the ceramic powder is densified while the glass component is fluidized and the rate is such that the glass component precipitates a crystalline substance after the ceramic powder is densified, as claimed in Claim 1.

It would have been obvious to one of ordinary skill in the art to have further modified the method of Fukuta et al. by providing the $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2\text{-B}_2\text{O}_3$ glass as one that, in addition to crystallizing into anorthite, also crystallizes into akermanite, as Nishigaki et al. '066 teach that an impurity in glass of the $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2\text{-B}_2\text{O}_3$ system can be MgO and Martin teaches that thermally-crystallizable glass compositions of $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2$ that contain MgO crystallize into gehlenite-akermanite-anorthite as the predominant crystalline phases. By including up to 10% of MgO as an impurity in the glass, akermanite is precipitated in addition to anorthite during sintering, as suggested by Martin.

By providing the glass of the greensheets as a glass of the $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2\text{-B}_2\text{O}_3$ system, the glass is a borosilicate glass, as claimed in Claims 6 and 10.

(4)

Claims 3-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claims 2 above, and further in view of Hakotani et al. 5,370,759.

Hakotani et al. teach that multilayered ceramic substrates are for mounting and interconnecting electronic components (col. 1, lines 7-10).

It would have been obvious to one of ordinary skill in the art to have modified the method of the references as combined by mounting an electronic component on the multilayer ceramic substrate after sintering, as Hakotani et al. teach that multilayered ceramic substrates are for mounting and interconnecting electronic components.

Response to Arguments

(5)

Applicant's arguments filed August 4, 2003 have been fully considered but they are not persuasive.

Applicant argues that Fukuta and Hakotani do not suggest the specified heating rate and argues that no reference suggest precipitating forsterite, akermanite or diopside crystal phase from the glass component. Applicant argues that Nishigaki is not concerned with a non-shrinkage process and argues that there is no suggestion to use a glass that precipitates akermanite in the Fukuta process.

(6)

Fukuta et al. disclose making a circuit substrate using greensheets of alumina and glass of the $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2\text{-B}_2\text{O}_3$ system and constraining layers. Nishigaki et al. '921 is pertinent to

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the method of Fukuta et al. because the reference teaches that for sintering greensheets of alumina and $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2\text{-B}_2\text{O}_3$ system glass, sintering rates of 20-200°C/min are beneficial and advantageous to retain the ceramic in a porous state up to the firing temperatures of 730-850°C without causing softening and shrinking of the glass phase so that binder is removed without causing cracks or incorporating carbon, to rapidly shrink and sinter the ceramic during firing to obtain a dense ceramic substrate in a shortened period and to minimize deformation of fine conductor pattern. While Nishigaki et al. teach using a glass that precipitates crystalline anorthite, the Martin reference is pertinent because it suggests that $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2\text{-B}_2\text{O}_3$ system glass that precipitates gehlenite, akermanite and anorthite as the predominant crystalline phases are especially suitable for glass-ceramic substrates for integrated circuit packaging. Thus, providing a glass that precipitates akermanite would have been obvious to one of ordinary skill in the art.

Conclusion

(7)

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Taguchi et al. disclose making a glass-ceramic substrate from a glass that precipitates forsterite as a subordinate crystalline phase.

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(8)

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.


(9)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melvin Curtis Mayes whose telephone number is 703-308-1977. The examiner can normally be reached on Mon-Fri 7:00 AM - 3:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Crispino can be reached on 703-308-3853. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.


Melvin Curtis Mayes
Primary Examiner
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MCM